## CERTIFICATE BY GUIDE

Certified that **DR. VAIBHAV SHARMA,** is a Bonafide post-graduate student in the department of Oral And Maxillofacial Surgery in M. M. College of Dental Sciences and Research, Mullana , District Ambala, Haryana and is registered with M. M. (Deemed to be) University, Mullana , Ambala. He shall carry out genuine, scientific research work on his dissertation project on **"Comparative Evaluation of transcutaneous electric nerve stimulation (TENS) assisted versus conventional impacted mandibular third molar surgery"** under our direct supervision.

**Dr. Dinesh Kumar**

**Guide**

**Associate Professor**

**Dept. Of Oral and Maxillofacial Surgery,**

**M.M. College of Dental Sciences &**

**Research, Mullana (Ambala)**

**DATE: 5/03/26**

**MAHARISHI MARKANDESHWAR COLLEGE OF DENTAL SCIENCES AND RESEARCH, MULLANA, AMBALA – 133203**

**HARYANA,**

| Sr. No | Content | Page No. |
|---|---|---|
| | | |
| 1. | Title page | 1-2 |
| 2. | Application form | 3 |
| 3. | Certificate by Guide | 4 |
| 4. | Certificate by Head | 5 |
| 5. | Declaration | 6 |
| 6. | Contents | 7 |
| 7. | Introduction | 8-9 |
| 8. | Aim and Objectives | 10 |
| 9. | Review of Literature | 11-13 |
| 10. | Materials and Method | 14-19 |
| 11. | Clinical Significance | 20 |
| 12. | References | 21-22 |
| 13. | Annexure:<br>1. Case History Proforma<br>2. Consent form | 21-27<br>28-33 |
| 14. | Plagiarism Report | |

# "Comparative Evaluation of transcutaneous electric nerve stimulation (TENS) assisted versus conventional impacted mandibular third molar surgery"

## INTRODUCTION

Surgical extraction of impacted mandibular third molars is one of the most performed procedures in oral and maxillofacial surgery. Surgical extraction of mandibular third molar is different as it requires reflection of soft tissue and bone cutting is more than other surgical tooth extraction. Despite being routine, it is frequently associated with postoperative complications such as pain, swelling, trismus, bleeding and alveolar osteitis. These adverse effects may significantly impair patient's functional activities including mastication, speech, and oral hygiene. It also causes psychological discomfort and anxiety regarding future dental treatments. Consequently, effective postoperative management is essential to improve patient comfort, satisfaction, and overall treatment outcomes. [1, 2]

In dentistry, pain perception remains a major barrier to seeking treatment with dental fear or algophobia, often leading to avoidance of necessary care. [3, 4] Pain control strategies can broadly be divided into pharmacological approaches such as local anaesthetic and postoperative analgesics and non-pharmacological methods. Among non-pharmacological modalities, Transcutaneous Electrical Nerve Stimulation (TENS) has gained increasing popularity or attention as a safe and non-invasive technique for pain management. TENS is low intensity, non-harmful process which relieves pain through a segmental mechanism. Higher intensity of TENS acts as pain gateway and therefore TENS raises the chance of activating extra segmental descending pain inhibitory pathways and diffuse noxious inhibitory controls through counter-irritant effects. TENS will also lead to a peripheral blockade of afferent impulses that come from peripheral structures. TENS has demonstrated efficacy in managing both acute and chronic pain conditions including neuropathic, musculoskeletal and osteoarthritic pain. In dental practice, it has been applied in various procedures such as restorative treatments, endodontic therapy, local anaesthesia facilitation, and minor surgical interventions. [5-7] Postoperative oedema following third molar surgery typically results from surgical trauma, soft tissues and bone leading to increased vascular permeability and an acute inflammatory response. Accumulation of inflammatory exudates can exert pressure on sensory nerve endings, thereby intensifying pain perception. TENS therapy may help to reduce these

postoperative sequelae as improves local blood circulation, enhances oxygen and nutrient delivery, promotes tissue healing and facilitates resolution of inflammation.

Furthermore, trismus—often caused by spasm of the masticatory muscles after surgical manipulation—may be alleviated through TENS stimulation as the electrical impulses mimic physiological neural signals, potentially reducing muscle spasm and improving mandibular mobility.[8-10] Overall, TENS appears to be a promising contributory modality for minimizing postoperative discomfort and enhancing early recovery following impacted mandibular third molar surgery.[11]

Hence, the present study will be conducted to compare the role of TENS therapy versus conventional post-operative management after the surgical extraction of mandibular third molar.

# AIM AND OBJECTIVES

## AIM:

To compare the effectiveness of transcutaneous electrical nerve stimulation (TENS) versus conventional therapy in postoperative sequelae like pain, swelling and trismus following surgical extraction of impacted mandibular third molar.

## OBJECTIVE:

1. To evaluate
    - Efficacy of postoperative TENS therapy following impacted mandibular third molar surgery in pain management.
    - The effect of TENS on Post operative facial swelling.
    - The effect of TENS on postoperative trismus.

2. To compare the clinical outcomes between TENS treated surgical sites and control sites without TENS application.

# REVIEW OF LITERATURE

1) **Arabion H et. al in 2017** assessed the efficacy of TENS as an adjunctive pain relief measure after impacted third molar surgery. Patients requiring surgical extraction of third molars (Class 2 and B of Pell and Gregory) were randomly divided into two groups. Group I subjects received TENS immediately after surgery along with analgesics (400 mg Gelofen). In group II, patients received 400 mg Gelofen immediately post-operation (control group). The pain intensity was evaluated using a visual analog scale (VAS) eight hours after surgery. The independent t-test was applied to compare pain intensity between the two groups. Three-hundred subjects were studied in two groups (each group had 150 participants). The mean pain intensity score was 3.7±1.43 in group I and 4.36±1.66 in group II. A significant difference was noted for pain intensity between the two groups (P=0.001). Use of TENS may decrease pain intensity during the first eight hours after impacted third molar surgery and may obviate the need for additional doses of non-steroidal anti-inflammatory drugs (NSAIDs).[13]

2) **Çebi et. al in 2019** assessed the therapeutic efficacy of transcutaneous electrical nerve stimulation (TENS) in reducing postoperative pain following surgical extraction of impacted mandibular third molars. The study included patients undergoing bilateral third molar removal, where one surgical episode involved routine postoperative care, while the subsequent procedure incorporated TENS therapy applied over the affected cheek region in addition to standard treatment. Postoperative pain intensity was evaluated at multiple time intervals using the Visual Analog Scale (VAS), and statistical comparison between groups was performed using the student's t-test. The results demonstrated significantly lower postoperative pain scores in the TENS-treated group compared with routine management alone, indicating enhanced analgesic effectiveness. The authors concluded that TENS modulates neural pain pathways and serves as a safe, non-pharmacological adjunct for postoperative pain control following impacted third molar surgery.[14]

3) **Cacho A et. al in 2022** examined the usefulness of weekly applications of transcutaneous electrical nerve stimulation (TENS) for this purpose, based on the evidence of its effectiveness in other types of patients with muscle alterations. Maximum jaw opening, bite force, pain, and facial inflammation were compared

between patients receiving TENS and those receiving sham-TENS for 30 min at baseline and weekly over a four-week period after orthognathic surgery and were also compared between the before and after of each procedure. TENS was applied at 220 Hz, applying the maximum intensity tolerated by each individual patient. The TENS procedure was identical for all patients, but the device was not turned on in the sham-TENS group. Patients were blinded to their group membership. Results were analysed separately in skeletal class II and III patients. Improvements in jaw opening and inflammation were significantly greater in the TENS than in the sham-TENS group, attributable to the muscle relaxation achieved with the procedure. Research is warranted on the benefits of a more frequent application of TENS.[15]

4) **Vivigdha V et. al in 2022** investigated the combined effects of transcutaneous electrical nerve stimulation (TENS) and therapeutic taping on spasticity, muscle strength, and gait performance in patients with stroke. Participants underwent structured functional training sessions over several weeks, with both groups receiving TENS stimulation, while one group additionally received taping to the lower limb region. Clinical parameters including spasticity, muscle strength, and gait speed were assessed using standardized measurement techniques. The study demonstrated greater improvement in spasticity reduction, muscle strength enhancement, and gait ability in the group receiving combined TENS and taping compared with TENS alone. The authors suggested that adjunctive taping may augment the neuromodulatory effects of TENS, improving functional outcomes in stroke rehabilitation, although further long-term studies were recommended to confirm sustained benefits.[16]

5) **Singhal et. al (2024)** evaluated the safety and effectiveness of low-level laser therapy (LLLT) and transcutaneous electrical nerve stimulation (TENS) in managing postoperative pain, swelling, and trismus following surgical extraction of impacted mandibular third molars. In this randomized study, patients with bilaterally impacted third molars were allocated into two treatment groups, one receiving LLLT and the other TENS, with outcomes assessed over the postoperative recovery period. The findings indicated that both therapies were comparably effective in controlling postoperative pain. However, LLLT demonstrated superior efficacy in reducing postoperative facial swelling, while TENS showed greater benefit in improving mouth opening and reducing trismus during the recovery phase. The authors concluded that

both modalities are useful adjuncts for postoperative management, with each offering specific advantages in different aspects of recovery after impacted third molar surgery.[17]]

6) **Alizadeh A et. al in 2024** evaluated the impact of transcutaneous electrical nerve stimulation (TENS) on acute postoperative pain, edema, and trismus following surgical extraction of impacted mandibular third molars. Their randomized, double-blind split-mouth clinical trial included patients with bilaterally impacted mandibular third molars, where TENS therapy was applied postoperatively on one surgical site while the contralateral site received placebo stimulation. Pain was assessed over the postoperative period, while edema and trismus were evaluated at designated follow-up intervals. The findings showed significantly reduced postoperative pain and decreased analgesic consumption in the TENS-treated group. Although facial swelling was lower in the TENS group, the difference was not statistically significant. Improvement in mouth opening became significant after the early postoperative phase. The authors concluded that TENS may serve as an effective non-pharmacological adjunct for controlling postoperative pain and improving functional recovery after impacted third molar surgery.[18]

7) **Rajan R et. al in 2026** evaluated the effectiveness of transcutaneous electrical nerve stimulation (TENS) in controlling perioperative pain and postoperative oedema and trismus following surgical extraction of impacted mandibular third molars. Their prospective, randomized, double-blind comparative clinical study included patients requiring bilateral mandibular third molar removal, with TENS applied preoperatively, immediately after surgery, and on the third postoperative day at the designated study site. The findings indicated that perioperative and postoperative use of TENS contributed to improved pain control, reduced facial swelling, and earlier recovery of mouth opening compared with the control site. Overall, postoperative recovery was superior in the TENS-treated group, suggesting that perioperative TENS application may facilitate faster functional recovery after third molar surgery.[10]

# MATERIALS AND METHOD

## STUDY DESIGN:

A non-randomized clinical trial will be conducted using a split-mouth design to evaluate the effect of TENS therapy on pain, swelling and trismus following surgical extraction of impacted mandibular third molars.

## STUDY SETTING:

This study will be carried out on 18 patients who will be coming for surgical extraction of bilateral impacted mandibular third molar at the Department of Oral and Maxillofacial Surgery at Maharishi Markandeshwar College of Dental Sciences and Research (MMCDSR), M.M. (Deemed to be University), Mullana, Ambala. Once the Institutional Research Review Board and Institutional Ethical Committee have given their proper clearance, the study will proceed.

## SOURCE OF DATA:

Patients with bilateral impacted mandibular third molar reporting to the outpatient department (OPD), Department of Oral and Maxillofacial Surgery, M.M.C.D.S.R, and Casualty- Maharishi Markandeshwar Super Speciality Hospital, M.M. (Deemed to be University), Mullana, Ambala will be selected for the study. Informed consent will be taken from each patient.

## SELECTION CRITERIA:

### INCLUSION CRITERIA:

- Patients aged 18 years and above.
- Patients requiring bilateral surgical extraction of impacted mandibular third molars confirmed clinically and radiographically.
- Patients classified as ASA (American Society of Anaesthesiologists) Class I or II.
- Patients willing to participate and provide written informed consent.

### EXCLUSION CRITERIA:

- Pregnant or lactating women.
- Patients with cardiac pacemakers or implanted electronic devices.

- Individuals with a history of epilepsy, cerebrovascular disorders, or neurological conditions contraindicating TENS therapy.
- Patients with acute infections or systemic conditions affecting healing.

## STUDY MATERIAL

TENS machine (MEDDEY TECHNOLOGIES PVT LTD)

- Channels models-
    1. 2-channel models deliver stimulation to two areas simultaneously
    2. 4-channel models available in some units
- Frequency range-2 Hz to 250 Hz
- Timer- Digital timer (0 – 99 minutes)
- Power- usually 220V AC / 50 Hz
- Accessories included:
    1. Electrode pads
    2. Lead wires
    3. Velcro strap
    4. Carrying case
    5. Gel bottle

## SAMPLE SIZE;

Sample will be divided into two sites- one will be managed by TENS therapy and other using the conventional post-operative management after the surgical extraction of mandibular third molar.

## SELECTION OF STUDY SITES:

Sites will be determined by Coin toss method beforehand. If "head" comes, the site will be allotted as Site A (study site) where surgical extraction of right mandibular third molar followed by TENS therapy will be done and if "tail" comes then the site will be allotted as site B (control group) where surgical extraction of left mandibular third molar followed by conventional therapy will be done.

## PARAMETERS TO BE STUDIED:

- Pain score (WONG BAKER SCALE[19]
- Swelling
- Trismus
- Number of analgesics consumes:

All parameters will be evaluated at immediate postoperative (6 hours), 1st day ,3rd day and 7th day

## ARMAMENTARIUM:

- Probes
- Mouth mirrors
- Tweezers
- Sterile gloves
- Disposable syringes (2ml) with needles (24 gauge)
- Lox 2%. (Lignocaine 2% with adrenaline 1:2,00,000)
- Surgical scalpel no.3
- Bard Parker blade no. 15
- Molt's #9 Periosteal elevators
- Howarth's periosteal elevators
- Adson's tissue holding forceps- Toothed and non-toothed
- Austin's tissue retractors
- Kilner's cheek retractors
- Coupland elevators
- Warwick James elevators
- Cryer elevators
- Micromotor and high speed straight rotary handpiece
- Bone cutting burs (Straight fissure burs and round burs no. 701/702/703)
- Bite block
- Mandibular molar extraction forceps
- TENS machine (MEDDEY TECHNOLOGIES PVT LTD)
- Conductive gel

- Luca's curette
- Suction tips
- Suction tube
- Sterile gauze
- Sterile cotton
- Bone rongeurs
- Bone files
- Needle holders
- Scissors
- Straight mosquito forceps
- Curved mosquito forceps
- 3-0 silk reverse cutting suture
- Suture cutting scissors

## PREOPERATIVE PROCEDURE :

- Prior to the surgery, all patients will be examined clinically and asked for radiological investigation to rule out impacted mandibular third molar and will be asked to rinse mouth with 0.2% chlorhexidine for 30 seconds.

## SURGICAL PROCEDURE:

- All surgical procedure will be performed under aseptic conditions.
- Lignocaine with 1:2,00,000 epinephrine will be administered via inferior alveolar nerve block, lingual nerve block and long buccal nerve block.
- For all impacted mandibular third molar surgeries, a standard surgical approach will be used following an appropriate incision.
- Bone removal and tooth sectioning will be performed using surgical handpiece 1:1. Impacted third molar removal will be done, and debridement of the surgical sites will be done with curette and smoothening of sharp bony margins will be done with bone file.
- Primary closure of extraction socket of each patient will be achieved with simple interrupted sutures using 3-0 silk sutures.
- Post operative instructions will be given to all patients.
- Post extraction medications that will be prescribed in site A (study group):

1. Capsule Amoxiclav 625mg 3times a day for 5 days.

Post extraction medications that will be prescribed in site B (control group):

1. Capsule Amoxiclav 625mg 3times a day for 5 days.

2. Tablet Zerodol-sp 440mg S.O.S.

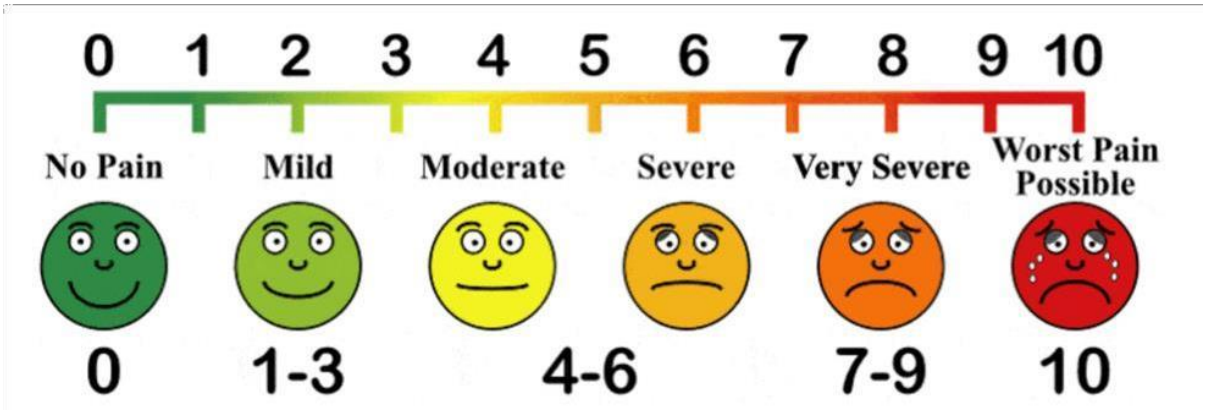
- After the extraction, patients will be followed up immediately post operatively (6hourly), 1st , 3rd and 7th day postoperatively for the evaluation of the parameters.

## POST OPERATIVE EVALUATION PARAMETERS

1. **PAIN ASSESMENT** -The estimation of pain will be done subjectively-

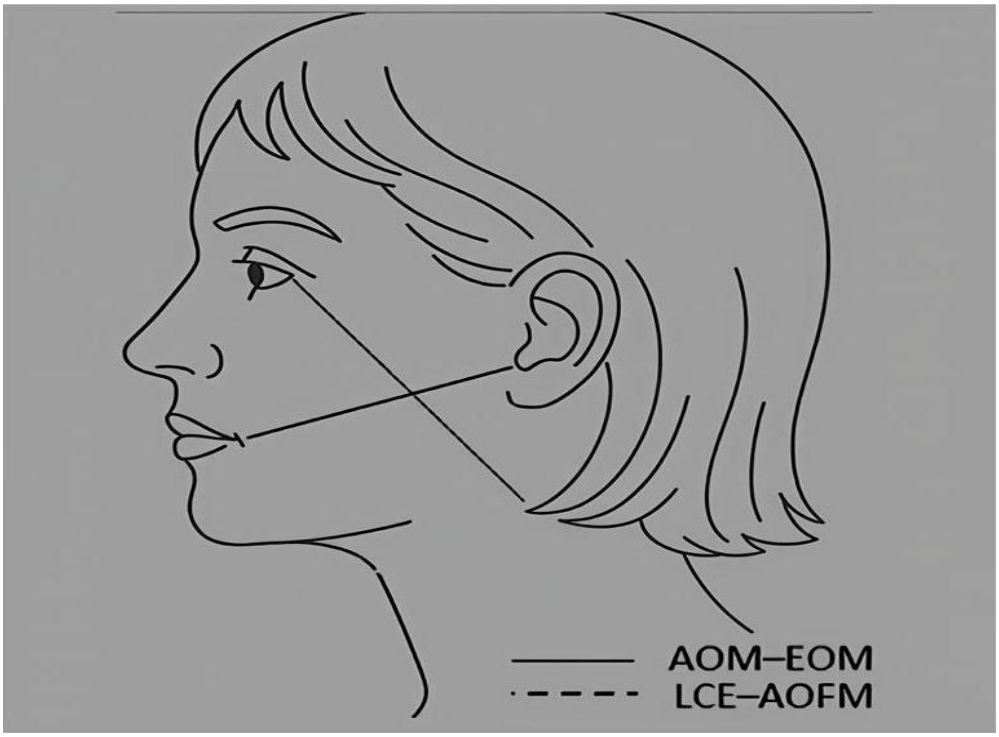
❖ by recording visual response of the patient (VAS)

❖ to rate his/her nociceptive experience on **Wong Baker scale** [19] which ranges from 0-10.




The values will be recorded immediate postoperatively (6 hour), 1st , 3rd and 7th day respectively).

**2) ASSESMENT OF SWELLING** - will be assessed by measuring the following distances[10]:




- **AOM-EOM:** horizontal line from angle of the mouth to the tragus of the ear
- **LCE-AOFM:** vertical from the lateral canthus of the eye to the angle of the mandible

The values will be recorded preoperatively and postoperatively (immediately and on 3rd day and the 7th day).

**3) ASSESMENT OF TRISMUS –**

Trismus will be assessed measuring the maximal mouth opening. Inter incisal distance will be measured between the mesial incisal corners of the right upper and lower central incisors on preoperative and postoperative 1st, 3rd, and 7th days.

The values will be recorded preoperatively and postoperatively (on 3rd day and the 7th day

**4) NUMBER OF ANALGESICS CONSUMES:**

Analgesics consumption will be recorded in terms of number of tablets taken by the patient during the first postoperative week.

# CLINICAL SIGNIFICANCE

Transcutaneous Electrical Nerve Stimulation (TENS) therapy has been shown to significantly reduce postoperative sequelae like pain, swelling and trismus in mandibular third molar impactions. It represents a safe and effective non-pharmacological approach to pain management. Its incorporation into post-operative care protocols may enhance patient comfort, decrease dependence on analgesic medications, and contribute to overall improved outcomes.

**Conflict of interest**: None

**Sponsorship**: Self

**Copyright infringement**: None

**Risk of subjects**: None

# REFERENCE


1. Archer WH. Oral and maxillofacial surgery. Saunders Philadelphia; 1975.

2. Passi D, Singh G, Dutta S, et al. Study of pattern and prevalence of mandibular impacted third molar among Delhi-national capital region population with newer proposed classification of mandibular impacted third molar: a retrospective study. Natl J Maxillofac Surg. 2019; 10:59-67.

3. Quek SL, Tay CK, Tay KH, Toh SL, Lim KC. Pattern of third molar impaction in a Singapore Chinese population: a retrospective radiographic survey. Int J Oral MaxillofacSurg. 2003; 32:548-552.

4. Grover PS, Lorton L. The incidence of unerupted permanent teeth and related clinical cases. Oral Surg Oral Med Oral Pathol. 1985; 59:420-425.

5. Raja SN, Carr DB, Cohen M, et al. The revised international association for the study of pain definition of pain: concepts, challenges, and compromises. Pain. 2020; 161:1976-1982.

6. Cacho A, Tordera C, Colmenero C. Use of transcutaneous electrical nerve stimulation (TENS) for the recovery of oral function after orthognathic surgery. J Clin Med. 2022; 11:32-68.

7. Kasat V, Gupta A, Ladda R, Kathariya M, Saluja H, Farooqui AA. Transcutaneous electric nerve stimulation (TENS) in dentistry- a review. J Clin Exp Dent. 2014;6: e562-e568.

8. do Carmo Almeida TC, Zatta SM, et al. Reduction on proinflammatory cytokines after application of transcutaneous electrical nerve stimulation (TENS) in patients with a breast cancer: a nonrandomized, open, and single-arm study protocol with paired analysis. Mediators Inflamm. 2022; 2022:1350813.

9. Serrano-Munoz D, Beltran-Alacreu H, Martin-Caro Alvarez D, et al. Effectiveness of different electrical stimulation modalities for pain and masticatory function in temporomandibular disorders: a systematic review and meta-analysis. J Pain. 2023; 24:946-956.

10. Rajan R, Thota E, Kumar JD, Potturi A, Reddy NVV, Bharath YW, Yeredla RKR. Role of transcutaneous electric nerve stimulation (TENS) in the mandibular third molar surgery: a clinical study. Oral Surg Oral Med Oral Pathol Oral Radiol. 2026; 141:36-43.

11. Fagade OO, Obilade TO. Therapeutic effect of TENS on post-IMF trismus and pain. Afr J Med Med Sci. 2003; 32:391-394.

12. Megia Garcia A, Serrano-Munoz D, Bravo-Esteban E, Ando Lafuente S, Avendano-Coy J, Gomez-Soriano J. Analgesic effects of transcutaneous electrical nerve stimulation (TENS) in patients with fibromyalgia: a systematic review. Aten Primaria. 2019; 51:406-415.
13. Arabion H, Kazemi H, Dehganian Y, Ebrahimi R, Tabrizi R. Evaluation of the effect of transcutaneous electrical nerve stimulation on postoperative pain in surgical extraction of impacted mandibular third molars: A double blind randomized clinical trial. Regener Reconstr Restor (Triple R). 2017;2(1):40-43.
14. Çebi AT. Effects of transcutaneous electrical nerve stimulation on pain after impacted third molar surgery. Med Oral Patol Oral Cir Bucal. 2019 May 1;24(3): e404-e408.
15. Cacho A, Tordera C, Colmenero C. Use of transcutaneous electrical nerve stimulation (TENS) for the recovery of oral function after orthognathic surgery. J Clin Med. 2022;11(12):3268.
16. Vivigdha V, Kumar S, Murugan SP, Meenakshi SP. Effectiveness of transcutaneous electrical nerve stimulation (TENS) and low-level laser therapy (LLLT) on postoperative sequelae in lower third molar surgery: A literature review. NeuroQuantology. 2022 Oct;20(12):1642-1648.
17. Singhal M, Goyal M, Lall AB, Tomar S, Sonal N. Evaluation of efficacy of transcutaneous electrical nerve stimulation (TENS) & low-level laser therapy (LLLT) on postoperative sequelae following surgical extraction of impacted mandibular third molars: A randomized control trial. J Pharm Negative Results. 2022;13(S7):2008-2015.
18. Alizadeh A, Karagah A, Tabrizi R, Shadman L, Arjmand A, Tofangchiha M, Patini R. Effect of transcutaneous electrical nerve stimulation on pain, edema, and trismus after surgical removal of impacted third molars: a split-mouth randomized clinical trial. Med Oral Patol Oral Cir Bucal. 2024 Mar 1;29(2): e211-8.
19. Adeboye A, Hart R, Senapathi SH, Ali N, Holman L, Thomas HW. Assessment of Functional Pain Score by Comparing to Traditional Pain Scores. Cureus. 2021 Aug 3;13(8):e

**PATIENT INFORMED CONSENT FORM**

Title of the project: "**"Comparative Evaluation of transcutaneous electric nerve stimulation (TENS) assisted versus conventional impacted mandibular third molar surgery"**

I have been informed of the purpose of the procedure and how it will benefit my treatment. The procedure has been described to me and I understand how it will be accomplished. The nature, objective, duration and expected effects of the study have been explained to me in a language in which I am conversant. I had the time and opportunity to enquire about the study and I have been fully satisfied with the explanations given.

- I am ready to participate voluntarily in this study.
- I understand that I am at liberty to withdraw from this study at any time without justifying my decision to withdraw.
- I know that the results from this study may be forwarded to the suitable authorities, presented in scientific meetings and published.
- By signing this consent form, I have not given up any legal rights which I am otherwise entitled to as subject in this study.
- I know that I will be given a copy of this consent form which is signed and dated.

Signature of the participant:Date:

Signature of the witness:Date:

Signature of the investigator:Date:

Synopsis_1725711_Vaibhav

ORIGINALITY REPORT

| 9% | % | 9% | % |
|---|---|---|---|
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

MATCH ALL SOURCES (ONLY SELECTED SOURCE PRINTED)

2%

★ I. Jones. "Transcutaneous electrical nerve stimulation", Continuing Education in Anaesthesia Critical Care & Pain, 06/26/2009

Publication

| | | | |
|---|---|---|---|
| Exclude quotes | On | Exclude matches | < 1% |
| Exclude bibliography | On | | |